

## **REMARKS**

- Claims 1-4 were previously pending.
- Claims 1-4 are currently amended.
- Claims 6-8 are new.
- Claims 1-4 and 6-8 are currently pending.

### **Claim Rejections Under 35 USC § 103(a)**

Claims 1-4 were rejected under 35 USC § 103(a) as being unpatentable over **Haugen** et al., “Simulation of Independent Reservoirs Couple by Global Production and Injection Constraints,” in view of **Briens** et al., “Application of Sequential Staging of Tasks to Petroleum Reservoir Modeling,” in view of U.S. Patent No. 6,108,608 to **Watts**, “Method of Estimating Properties of a Multi-Component Fluid Using Pseudocomponents.”

### **Claims 1 and 2**

Claim 1 recites a method of controlling the coupling of multi-platform reservoir and network simulators. Similarly, Claim 2 recites a controller for coupling multi-platform reservoir and network simulators. Similar amendments have been applied to both Claim 1 and Claim 2. No new matter has been added by the amendments, which use language taken from the specification.

Amended Claim 2 defines elements of the controller for coupling multi-platform reservoir and network simulators, including:

- means for interfacing via open message-passing with different types of simulation tasks including black oil model reservoir simulations, compositional model reservoir simulations, and different types of surface networks;
- means for initiating a first reservoir simulation for one or more physical parameters of a first reservoir in a first reservoir simulator, the first reservoir simulation using a first fluid model;
- means for initiating a second reservoir simulation for the one or more physical parameters in a second reservoir in a second reservoir simulator, the second reservoir simulation using a second fluid model;
- means for ~~synchronizing~~ applying synchronization steps to the advancement through time of the first reservoir simulation executing on a first computing device and the second reservoir simulation executing on a second computing device, each synchronization step enabling different simulation tasks to take non-identical time steps, wherein each simulation task of the first reservoir simulation and the second reservoir simulation advances independently to the next synchronization step using corresponding time steps and Newton iterations uniquely suited to the individual simulation task;
- means for translating each of a first hydrocarbon fluid stream of the first reservoir simulation and a second hydrocarbon fluid stream of the second reservoir simulation to a common fluid model of the controller by converting pseudo-components of each of the first

hydrocarbon fluid stream and the second hydrocarbon fluid stream to a super-set of pseudo-components used in the first reservoir simulator and the second reservoir simulator; and

- means for performing a production operation based on the first reservoir simulation of the first reservoir simulator and the second reservoir simulation of the second reservoir simulator, the first reservoir simulation performed on the first computing device and the second simulation performed on the second computing device using the converted hydrocarbon fluid streams.

The cited references, Haugen, Briens, and Watts, alone or in combination, do not appear to teach or suggest an open message-passing interface adapted to couple reservoir simulation tasks being performed under different simulation models (e.g., black oil models and compositional models). These references also do not appear to teach or suggest a loose coupling scheme in which each simulation task advances independently to synchronization waymarks, taking whatever time steps each simulation task requires. Haugen, for instance, appears to describe a tight coupling scheme, in which all the simulation tasks are required to take identical time steps.

The Applicant therefore respectfully requests that the 35 USC § 103(a) rejections of Claim 1 and Claim 2 be removed.

### **Claims 3 and 4**

Claims 3 and 4 have been amended for clarity. No new matter is added by the amendments, which closely follow language in the specification.

Claims 3 and 4 include the all the language and limitations of their base claim, Claim 2. Thus, Applicant suggests that since Claim 2 is allowable, Claims 3 and 4 are allowable in turn.

### **New Claims 6-8**

New Claims 6-8 are added to recite further features of the controller recited in Claim 2. For example, Claim 6 recites the controller coupling a black oil model reservoir simulation with a compositional model reservoir simulation. Claims 7 recites the controller coupling a mixture of black oil models that each have different sets of active phases, and compositional models with different sets of pseudo-components. Claim 8 recites the controller coupling reservoir simulators that are running on different computer platforms.

### **Conclusion**

Applicant submits that the pending Claims 1-4 and 6-8 are in condition for allowance and respectfully requests issuance of the subject application.

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